Binational LULC dataset information

U.S. Geological Survey
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Overview

An integral part of the U.S.-Mexico Border Environmental Health Initiative (BEHI) geospatial database is a land use/land cover (LULC) base map layer. LULC data can be used to analyze landscape change, to provide data for hydrologic modeling applications, to statistically analyze landscape fragmentation, and as a base layer for regional maps. As the BEHI project expands, the described methods could be implemented to create a binational LULC dataset for the entire U.S.-Mexico border.

Data

The two sources of national land cover data include:

Mexico: 1993 Instituto Nacional de Estadística, Geografía, e Informática (INEGI) 1:250,000 scale Uso de Suelo (Land Use) Serie II vector (polygon) map

U.S.: 1992 U.S. Geological Survey National Land Cover Dataset (NLCD92) 30m resolution raster

The INEGI Uso de Suelos and the NLCD92 datasets were chosen because they represent a consistent nationwide classification system for their respective countries. Landsat imagery was the source data used to classify and create both the U.S. and Mexico LULC datasets. However, the classifications were conducted using different methods. USGS, in cooperation with the U.S. Environmental Protection Agency (EPA), created the NLCD92 using unsupervised classification methods along with ancillary datasets, such as elevation data, local land cover datasets, and wetlands inventories. The final dataset is a 21-class LULC raster dataset with 30-meter spatial resolution. INEGI's LULC dataset was also derived using Landsat imagery, but was created utilizing manual methods. LULC types were visually interpreted from the Landsat imagery. Polygons were digitized to delineate LULC types and then verified with fieldwork. The final INEGI dataset consists of a polygon layer, which has 89 LULC classes in the BEHI study area.

Land Cover Integration

The process for creation of the binational LULC dataset consists of the following basic geographic information system (GIS) procedures:

1. Convert input LULC datasets to the same format and coordinate system.
2. Reclassify LULC datasets to a modified Anderson Level I.
3. Clip USA and Mexico LULC datasets using a common international boundary.
4. Merge clipped and reclassified data into binational LULC dataset.

Classification schemes for the US LULC dataset and the Mexico LULC dataset are quite different. Classification of the US data used an Anderson Level II classification scheme. The Mexico dataset was created using a single-factor classification scheme to produce a detailed LULC dataset with many species-level classifications. In order to successfully integrate both countries' data, a modified Anderson Level I classification scheme was devised to maximize the level of classification detail to the extent possible. Anderson and others suggest the following LULC classes for a Level I classification: urban or built-up land, agricultural land, rangeland, forestland, water, wetland, barren land, tundra, and perennial ice or snow. In the modified Anderson Level I classification scheme, it is possible to split the Anderson Level I rangeland class into two classes, shrubland and grassland/pasture. The remaining classes are identical in both the Anderson Level I classification scheme and the modified classification scheme. Tundra and perennial ice were excluded because they did not exist in the study area.

Anderson Level I	Modified Level I
urban or built-up land	urban or built-up land
agricultural land	agricultural land
rangeland	grassland
	shrubland
forestland	forest
water	water
wetland	wetland
barren land	barren land

Not surprisingly, one of the LULC classes did not fit perfectly into this schema. The Mexico LULC dataset contains a class known as "halophilic vegetation". It occurs along the Gulf Coast as well as inland in arid landscapes. In order to create a better fit for binational integration, the halophilic vegetation class polygons that intersected the coast were reclassified as wetland. The remaining halophilic vegetation polygons were converted to shrubland. The decision to reclassify was based on evidence from the wetland class in the US LULC dataset and aerial imagery. This class was the most problematic for binational integration.

The full integration process consists of several pre-processing steps, a geoprocessing model created with ESRI ArcGIS 9.0 software, and some post-processing steps. The detailed process steps are as follows:

1. Create a common unofficial international boundary by digitizing the center of the Rio Grande/Río Bravo using 1-meter resolution orthoimagery from 2004.
2. Use the common international boundary to create polygon masks for USA and Mexico for clipping land cover data.
3. Convert polygon masks to 30-meter resolution raster data.
4. Select "halophilic vegetation" polygons that intersect the coastline and reclassify them to "wetland".

5. Convert Mexico LULC vector land cover data to 30-meter resolution raster data.
6. Reclassify USA LULC raster data to modified Anderson Level I using reclassification table (see Table 1).
7. Reclassify Mexico LULC raster data to modified Anderson Level I using reclassification table (see Table 2).
8. Clip reclassified USA and Mexico LULC raster data using raster masks.
9. Mosaic clipped reclassified USA and Mexico LULC raster data to a new binational LULC 30-meter raster dataset (see Table 3).
10. Assign display colors for each class using a color map.

Summary

The result of the reclassification is a binationally integrated 30-meter resolution LULC raster dataset. The dataset is intended for use at broad spatial scales, i.e. from about 1:1,000,000 to the entire U.S.-Mexico border.

Tables

Table 1. NLCD92 classes with description and binational LULC class

NLCD class	NLCD description	Binational LULC class
11	Open Water	5
12	Perennial Ice/Snow	6
21	Low Intensity Residential	1
22	High Intensity Residential	1
23	Commercial, Industrial, Transportation	1
31	Bare Rock, Sand, Clay	6
32	Quarries, Strip Mines, Gravel Pits	6
33	Transitional	6
41	Deciduous Forest	3
42	Evergreen Forest	3
43	Mixed Forest	3
51	Shrubland	4
61	Orchards, Vineyards, Other	2
71	Grasslands, Herbaceous	7
81	Pasture, Hay	7
82	Row Crops	2
83	Small Grains	2
84	Fallow	2
85	Urban, Recreational Grasses	1
91	Woody Wetlands	8
92	Emergent Herbaceous Wetlands	8

Table 2. Mexico LULC classes with type description and binational LULC class

Mexico land cover unique ID (FC)	Mexico land cover type	Binational LULC class
6122	Agriculture	2
6151	Agriculture, irrigated	2
6152	Agriculture, irrigated	2
6154	Agriculture, irrigated	2
6156	Agriculture, irrigated	2
6158	Agriculture, irrigated	2
6162	Agriculture, irrigated	2
6164	Agriculture, irrigated	2
6166	Agriculture, irrigated	2
6170	Agriculture, irrigated	2
6172	Agriculture, irrigated	2
6174	Agriculture, irrigated	2
6178	Agriculture, irrigated	2
6182	Agriculture, irrigated	2
6211	Agriculture	2
6212	Agriculture	2
6213	Agriculture	2
6214	Agriculture	2
6218	Agriculture	2
6234	Agriculture	2
6236	Agriculture	2
6250	Area without vegetation	6
6251	Area without vegetation	6
6272	Forest	3
6274	Forest	3
6276	Forest	3
6282	Ayarin forest	3
6284	Ayarin forest	3
6292	Water body	5
6297	Oak forest	3
6298	Oak forest	3
6299	Oak forest	3
6300	Oak forest	3
6302	Oak forest	3
6305	Oak-pine forest	3
6306	Oak-pine forest	3
6308	Oak-pine forest	3
6314	Gallery forest	3
6316	Gallery forest	3
6322	Oyamel forest	3
6324	Oyamel forest	3
6330	Pine forest	3

Mexico land cover unique ID (FC)	Mexico land cover type	Binational LULC class
6332	Pine forest	3
6334	Pine forest	3
6340	Pine-oak forest	3
6345	Juniper forest	3
6346	Juniper forest	3
6348	Juniper forest	3
6404	Matorral	4
6412	Matorral	4
6414	Matorral	4
6429	Matorral, desert	4
6430	Matorral, desert	4
6431	Matorral, desert	4
6432	Matorral, desert	4
6433	Matorral, desert	4
6434	Matorral, desert	4
6436	Matorral, desert	4
6438	Matorral, desert	4
6439	Matorral, desert	4
6440	Matorral, desert	4
6453	Matorral, desert	4
6454	Matorral, desert	4
6456	Matorral, desert	4
6457	Matorral, rosette-dominated desert	4
6458	Matorral, rosette-dominated desert	4
6459	Matorral, rosette-dominated desert	4
6460	Matorral, rosette-dominated desert	4
6461	Matorral, rosette-dominated desert	4
6462	Matorral, rosette-dominated desert	4
6472	Matorral, rosette-dominated desert	4
6473	Matorral, rosette-dominated desert	4
6474	Matorral, rosette-dominated desert	4
6481	Matorral, rosette-dominated desert	4
6482	Matorral, rosette-dominated desert	4
6486	Matorral, tamaulipan	4
6487	Matorral, tamaulipan	4
6488	Matorral, tamaulipan	4
6489	Matorral, tamaulipan	4
6490	Matorral, tamaulipan	4
6509	Matorral, tamaulipan	4
6510	Matorral, tamaulipan	4
6511	Matorral, tamaulipan	4
6512	Matorral, tamaulipan	4
6514	Matorral, coastal	4
6516	Matorral, coastal	4
6525	Urban area	1
6537	Matorral, coastal	4

Mexico land cover unique ID (FC)	Mexico land cover type	Binational LULC class
6538	Matorral, coastal	4
6598	Matorral	4
6599	Matorral	4
6600	Matorral	4
6602	Matorral	4
6622	Matorral	4
6626	Matorral, submontane	4
6627	Matorral, submontane	4
6628	Matorral, submontane	4
6630	Matorral, submontane	4
6649	Matorral, submontane	4
6650	Matorral, submontane	4
6654	Matorral, subtropical	4
6655	Matorral, subtropical	4
6656	Matorral, subtropical	4
6658	Matorral, subtropical	4
6677	Matorral, subtropical	4
6678	Matorral, subtropical	4
6692	Chaparral	4
6692	Chaparral	4
6694	Chaparral	4
6697	Acacia scrub	4
6721	Mesquite scrub	4
6722	Mesquite scrub	4
6722	Mesquite scrub	4
6723	Mesquite scrub	4
6724	Mesquite scrub	
6725	Mesquite scrub	4
6726	Mesquite scrub	4
6730	Palm	4
6746	Tular (marsh community)	4
6747	Desert shrub	4
6748	Desert shrub	4
6754	Coastal dune vegetation	4
6760	Riparian vegetation	4
6771	Halophilic vegetation	4*
6772	Halophilic vegetation	4*
6774	Halophilic vegetation	4*
6781	Grassland, cultivated	7
6782	Grassland, cultivated	7
6784	Grassland	7
6786	Grassland	7
6789	Grassland	7
6790	Grassland	7
6791	Grassland	7
6792	Grassland	7

Mexico land cover unique ID (FC)	Mexico land cover type	Binational LULC class
6795	Grassland, induced	7
6796	Grassland, induced	7
6797	Grassland	7
6798	Grassland	7
6799	Grassland	7
6800	Grassland	7
6804	Grassland	7
6810	Grassland, alpine	7
6999	Wetland	8

*along the coast, features in this class were assigned to the 8 – Wetland class, and given a modified FC code of 6999.

Table 3. Binational LULC classes with description

Binational LULC class	Binational LULC description
1	Developed
2	Agriculture
3	Forest
4	Shrubland
5	Water
6	Barren
7	Grassland/ Pasture
8	Wetland

References

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Links

USGS U.S.-Mexico Border Environmental Health Initiative
http://borderhealth.cr.usgs.gov

Instituto Nacional de Estadística, Geografía, e Informática (INEGI)
http://www.inegi.gob.mx

USGS National Land Cover Dataset (NLCD)
http://landcover.usgs.gov